

## Odjel za intenzivno kardiološko liječenje i aritmije Kliničke bolnice „Sveti Duh“

### The Department for Intensive Cardiological Treatment and Arrhythmias – at the University Hospital “Sveti Duh”

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#### Zavod za bolesti srca i krvnih žila kroz povijest

U travnju 1971. god. osnovana je u okviru Internog odjela tada druga koronarna jedinica u Republici Hrvatskoj (samo devet godina nakon osnivanja prve takve jedinice u svijetu). Primarijus dr. Josip Vuletić, koji je bio i dugogodišnji potpredsjednik Hrvatskoga kardiološkog društva, bio je njezin voditelj kao i voditelj odjela kardiologije koja se razvijala na toj jezgri. Od 1991. do 2001. voditelj odjela bio je prim. dr. Josip Halle, od 2001. do 2003. prof. dr. sc. Roman Urek, od 2003. do 2011. pročelnik Zavoda bio je prof. dr. sc. Jure Mirat. Od 2011. god. pročelnica je Zavoda je doc. dr. sc. Jozica Šikić, predsjednica Radne skupine za valvularne bolesti Hrvatskoga kardiološkog društva.

Godine 2003./2004. Zavod za bolesti srca i krvnih žila temeljito je obnovljen i restrukturiran kao prioritetni projekt na razini Republike Hrvatske. Suvremeno je opremljena jedinica za intenzivno liječenje kardioloških bolesnika, kao i angiosala za kateterizaciju srca i provođenje intervencijskih zahvata (perkutane koronarne intervencije s implantacijom stentova).

Jedinica za intenzivno liječenja kardioloških bolesnika zbrinjava životno najugroženije bolesnike s infarktom miokarda, malignim aritmijama i akutnim i kroničnim zatajivanjem srca u fazi akutizacije. Od 2011. godine uveden je program transplantacije srca u bolesnika s kroničnim zatajivanjem srca u sklopu kojeg se provodi predtransplantacijska obrada te posttransplantacijsko praćenje i liječenje. Osim transplantacijskoga programa, u liječenju kroničnog zatajivanja srca primjenjuju se i najsuvremenije mehaničke pumpe kao potpore lijevoj klijetki (Heart Mate II i III).

Zavod za bolesti srca i krvnih žila (**slika 1**) nastavna je baza Medicinskog fakulteta Sveučilišta u Zagrebu i Medicinskog fakulteta Sveučilišta Josip Juraj Strossmayer u Osijeku.

#### History of the Institute for Cardiovascular Diseases

The second Coronary Care Unit (CCU) in the Republic of Croatia was founded in April 1971 within the Internal Medicine Department (just nine years after the first such unit was opened globally). Chief Physician Dr Josip Vuletić, who was also the vice-president of the Croatian Cardiac Society for many years, was the unit's head and the head of the cardiology department that developed from that initial basis. Between 1991 and 2001 the department was led by Chief Physician Dr Josip Halle, between 2001 and 2003 by Prof Dr Roman Urek, PhD, and between 2003 and 2011 the institute director was Prof Dr Jure Mirat, PhD. Since 2011 the institute was directed by Assist Prof Dr Jozica Šikić, PhD, the president of the Working Group for Valvular Diseases of the Croatian Cardiac Society.

In 2003/2004 the Institute for Cardiovascular Diseases was fully renovated and restructured as part of a priority project at the level of the Republic of Croatia. The unit for intensive treatment of cardiological patients received modern equipment, as did the angiography hall for heart catheterization and performance of interventional procedures (percutaneous coronary interventions with stent implantation).

The unit for intensive treatment of cardiological patients cares for patients with the most severe life-threatening conditions resulting from myocardial infarction, malignant arrhythmias, and acute and chronic heart failure in the acutization phase. A program was introduced in 2011 for heart transplants in patients with chronic heart failure, which includes pre-transplant processing and post-transplant monitoring and treatment. In addition to the transplantation program, the treatment of chronic heart failure employs the most advanced mechanical pumps to support the left ventricle (Heart Mate II and III).

The Institute for Cardiovascular Diseases (**Figure 1**) is an educational base for the University of Zagreb Medical School and the Josip Juraj Strossmayer University Medical School in Osijek.

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FIGURE 1. A hallway in the Institute for Cardiovascular Diseases.

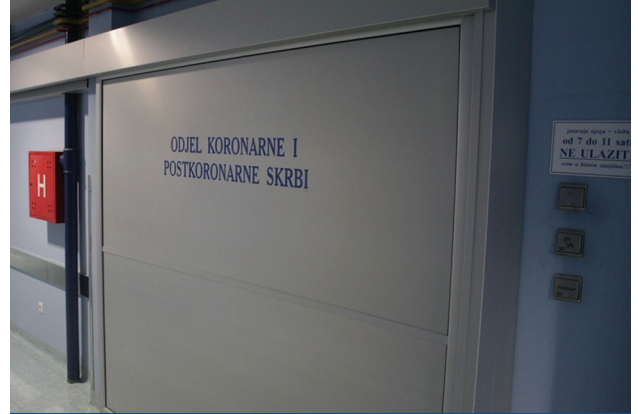


FIGURE 2. Entrance to the Coronary Care Unit.

## Odjel za intenzivno kardiološko liječenje i aritmije

Odjel za intenzivno kardiološko liječenje i aritmije (**slika 2**) organizacijska je jedinica unutar Zavoda za bolesti srca i krvnih žila, KB „Sveti Duh“, gdje se 24 sata na dan održava život, pruža hitna medicinska pomoć, provodi reanimacija na razini uznapredovalog održavanja života, provodi intenzivno liječenje, obavlja kontinuirani hemodinamski invazivni i neinvazivni monitoring i omogućuje stalan nadzor te visoko stručna zdravstvena njega.

Odjel za intenzivno kardiološko liječenje i aritmije raspolaže sa šest postelja. Uz svaki je krevet omogućeno pružanje najvišega stupnja intenzivnog liječenja.

U Koronarnu jedinicu (**slika 3**) primaju se i liječe vitalno ugroženi bolesnici, u kritičnome zdravstvenom stanju s ozbiljnim gubitkom jedne ili više životnih funkcija, te im je kao takvim životno ugroženim bolesnicima potrebno pružiti intenzivno liječenje, nadzor i njegu.

## The Department for Intensive Cardiological Treatment and Arrhythmias

The Department for Intensive Cardiological Treatment and Arrhythmias (**Figure 2**) is an organizational subunit under the Institute for Cardiovascular Diseases of the Sveti Duh Clinical Hospital (CH) that provides 24-hour life support, emergency medical treatment, reanimation at the level of advanced life support, intensive treatment, continuous hemodynamic invasive and non-invasive monitoring and constant supervision, and high-quality healthcare.

The Department for Intensive Cardiological Treatment and Arrhythmias has 6 bed units available. Every bed allows the provision of the highest level of intensive care.

The CCU (**Figure 3**) admits and treats patients in life-threatening critical conditions with severe loss of one or more vital functions, and must therefore provide intensive treatment, monitoring, and care for such life-threatening conditions.



FIGURE 3. The Coronary Care Unit.

## STRUKTURA ODJELA

Voditelj Odjela je prof. dr. sc. Goran Miličević, a glavni tehničar Tomislav Maričić, bacc. med. techn.

Na Odjelu radi 15 djelatnika, 2 medicinska tehničara, visoke stručne spreme, 4 medicinske sestre visoke stručne spreme i 9 medicinskih sestara srednje stručne spreme, od kojih trenutno samo jedna pohađa visoko zdravstveno veleučilište – smjer sestrinstvo. Prosječna dob osoblja je 31 godina.

U smjeni (princip: „12 – 24 – 12 – 48“) rade dvije medicinske sestre, a u jutarnjoj smjeni (7 – 15 h) još je i glavna sestra/tehničar te eventualno jedna sestra srednje stručne spreme.

## ORGANIZACIJA RADA

Centralna monitorska jedinica – svi su monitori umreženi i povezani s centralnom nadzornom jedinicom na sestriškom pultu, gdje se 24 sata na dan nadziru vitalne funkcije bolesnika. Centralna se nadzorna jedinica sastoji od centralnog servera, PC-a, 1 monitora i pisačem za ispis poremećaja ritma. Svaki poremećaj ili odstupanje centrala registrira i pohranjuje te je moguće u svakome trenutku dobiti uvid u arhivu alarma i drugih podataka.

U slučaju poremećaja ritma srca, aresta ili nekog drugog odstupanja od granica zadanih vrijednosti centralni će monitor zvučno i svjetlosno upozoriti tim medicinskih sestara i automatski ispisivati jedan ili više unaprijed određenih odvođa EKG-a i drugih podataka kao što su broj kreveta i ime bolesnika, datum i vrijeme, interpretaciju EKG-a i vrijednost pulsa, pojavu i broj ventrikulskih ekstrasistola, tlak i druge praćene parametre koji su zadani.

Medicinska je sestra odgovorna za parametre-granice alarma te je ujedno njezina dužnost da pri svakom prijmu bolesnika prilagodi granice alarma prema potrebama bolesnika. Tako se primjerice određuju granice kada će monitor alarmirati bradikardiju, tahikardiju, hipotenziju i hipertenziju, pad saturacije kisika u krvi, porast ili pad temperature i druge parametre koji se prate za pojedinog bolesnika.

Svi alarmi monitora moraju biti uključeni za cijelo vrijeme boravka bolesnika u Koronarnoj jedinici, jer, u suprotnom, monitor i alarm nemaju svrhe, tj. mogući poremećaj neće biti uočen navrijeme i na taj način može uzrokovati letalni ishod bolesnika.

Svaki alarm centralnog monitora medicinske sestre moraju ozbiljno shvatiti: otići do bolesnika, utišati alarme monitora, provjeriti bolesnikovo stanje, utvrditi razlog uključivanja alarma, otkloniti uzrok njegova uključivanja (ako je u domeni sestara, a u suprotnom pozvati liječnika), resetirati alarme, po potrebi pozvati liječnika i započeti mjere kardiopulmonalne reanimacije.

Kardiopulmonalna reanimacija (KPR) u Koronarnoj jedinici KB „Sveti Duh“ provodi se prema algoritmima uznapredovalog održavanja života Europskog vijeća za reanimatologiju (ERC) uz poštovanje etičkih i moralnih načela. Medicinske sestre i tehničari Koronarne jedinice samostalno započinju i provode postupak KPR-a do dolaska dežurnog liječnika i po potrebi anesteziologa te poslije u timskom radu nastavljaju i provode KPR. Najčešći razlog početka reanimacije u Koronarnoj jedinici jesu bradikardije i asistolije (s P-valom ili bez njega), dok su na drugome mjestu ventrikularna fibrilacija (VF) i ventrikularna tahikardija bez pulsa (VT) i pojavljuju se u bolesnika

## DEPARTMENT STRUCTURE

The department head is Prof Dr Goran Miličević, PhD, and the head nurse is Tomislav Maričić, BN.

The Department has 15 employees: 2 male nurses with a master's degree in nursing, 4 female nurses with master's degree in nursing, and 9 nurses with vocational nursing school of which currently only one is attending a nursing course at a university of healthcare sciences. The average employee age is 31 years.

Two nurses work per shift (based on the “12-24-12-48” principle), and the morning shift (07-15h) also includes the head nurse or one additional nurse with vocational school education.

## WORK ORGANIZATION

The central monitoring unit – all monitors are networked and connected with the central monitoring unit at the nurse desk, where patient vital functions are monitored 24 hours per day. The central monitoring unit consists of a central server, a PC, 1 monitor, and a printer to print data on rhythm dysfunction. Every disorder or deviation is registered and stored by the monitoring center, and the archive of alarms and other data can be accessed at any time.

In case of heart rhythm disorder, cardiac arrest, or some other deviation from previously defined standard values the monitor will provide a auditory and visual warning to the team of nurses and automatically present one or more of the previously established ECG leads and other data such as: bed number and patient name, date and time, ECG interpretation and pulse value, the emergence and number of ventricular extrasystoles, blood pressure, and other monitored parameters that have been assigned.

Nurses are responsible for the parameters – alarm values, and it is also their duty to adjust the alarm values to the specific needs of the patient upon admission. For instance, this includes determining the values at which the monitor will produce an alarm for bradycardia, tachycardia, hypertonia and hypotonia, oxygen saturation loss, increase or drop in temperature, and for other parameters monitored in individual patients.

All monitor alarms must be on during the entire duration of a patient's stay at the CCU because they otherwise cannot fulfil their purpose, i.e. a possible disorder may not be observed in time which may lead to a lethal outcome for the patient.

Ever alarm by the central monitor must be addressed seriously by the nurses: they must go to the patient, turn off the alarm, check the condition of the patient, determine the reason for the alarm, resolve the cause of the alarm (if it is within the domain of nurse duties or call a physician if it is not), reset the alarm, alert a physician if needed, and if necessary start cardiopulmonary reanimation measures.

Cardiopulmonary reanimation (CPR) at the University Hospital “Sveti Duh” Coronary Care Unit is performed according to the algorithm for advanced life support of the European Resuscitation Council (ERC) with adherence to ethical and moral principles. Nurses at the CCU independently start and perform the CPR procedure until the arrival of the on-call physician and anesthesiologist if they are required, and continue to provide CPR as part of the team after their arrival. The most common cause of CPR initiation at the CCU are bradycardia

koji su otprije srčani bolesnici ili pak u bolesnika s ozbiljnim elektrolitskim disbalansom.

Neki od postupaka edukacije medicinskih sestara/tehničara:

- kardiopulmonalna reanimacija (smjernice ERC-a)
- defibrilator – ispravno rukovanje i defibrilacija
- elektrokardiograf – brzo i kvalitetno snimanje 12-kanalnog EKG-a, po potrebi i desnih i posteriornih odvoda, kao i znanje unosa podataka, određivanja brzine izlaska papira i veličine amplitude
- prepoznavanje stanja i poremećaja ritma koji ugrožavaju život bolesnika
- privremena elektrostimulacija srca
- osnove ultrazvučne dijagnostike (visokoobrazovane medicinske sestre / tehničari)
- pravilno rukovanje sterilnim materijalima, uzetim uzorcima (krv, drugi dijagnostički materijali), kao i svim priborom u koronarnoj jedinici
- pristup bolesniku (edukacija, informiranje – pismeno/ usmeno).

#### OPREMA ODJELA ZA INTENZIVNO KARDIOLOŠKO LIJEČENJE I ARITMIJE

Koronarna jedinica raspolaže jednim kolicima za reanimaciju koja su smještena na samo za to predviđenu mjestu. Na reanimacijskim se kolicima nalazi defibrilator, koji sjedinjuje sam uređaj, kabele za monitoring, EKG elektrode za trajni nadzor srčane akcije, elektroprovodljivi gel i samoljepljive elektrode (za elektrostimulaciju, monitoring i defibrilaciju).

Opremu (**slika 4**) na Odjelu čine: 6 Nihon Kohden monitora povezanih s centralnim monitorom; 12-kanalni EKG uređaj, 6 infuzomata, 6 perfuzora, 2 neinvazivna ventilatora (NIV), BIS (praćenje stupnja sedacije), inhalator, prijenosni ultrazvučni aparat (kardiološka i vaskularna sonda), 4 baterije za privre-

and asystole (with or without P-wave presence) followed by ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT), which manifest in patients with previous cardiac issues or in patients with serious electrolyte disbalance.

Some of the procedures nurses are educated in:

- Cardiopulmonary reanimation (ERC guidelines)
- Defibrillator – correct handling and defibrillation
- Electrocardiography – rapid and high-quality imaging with a 12-lead ECG, including right and posterior leads, as well as knowing how to enter data and determine printing speed and amplitude size
- Recognizing conditions and rhythm disorders that threaten the life of the patient
- Temporary electric stimulation of the heart
- The basic of ultrasound diagnostics (highly educated nurses)
- Proper handling of sterile materials, samples (blood, other diagnostic materials), and all the tools in the CCU
- Approaching the patient (education, providing information – written/oral)

#### EQUIPMENT AT THE DEPARTMENT FOR INTENSIVE CARDIOLOGICAL TREATMENT AND ARRHYTHMIAS

The coronary unit is equipped with one reanimation cart placed in a designated location. The reanimation cart is equipped with a defibrillator that includes monitoring cables, ECG electrodes for continuous heart action monitoring, electroconductive gel, and self-adhesive leads (for pacing, monitoring and defibrillation).

The equipment (**Figure 4**) at the Department consists of: 6 Nihon Kohden monitors connected to a central monitoring system, a 12-lead ECG device, 6 infusion pumps, 6 perfusion pumps, 2 non-invasive ventilators, a bispectral index (BIS) device, an inhaler, a portable ultrasound device (cardiological and vascular probe), 4 batteries for temporary electrical heart



FIGURE 4. Equipment at the Coronary Care Unit.

menu elektrostimulaciju srca, 6 aspiratora, kolica za lijekove, kolica za invazivne zahvate, kolica za pripremu terapije, kolica za zdravstvenu njegu bolesnika.

Statistika Odjela prikazana je u **tablici 1.**

**Koronarna jedinica sutra – edukacijom osoblja, međusobnom sinkronizacijom i radom spriječiti ugrožavanje života te omogućiti brzu i kvalitetnu skrb za svakog pojedinca!**

stimulation, 6 aspirators, a medication cart, an invasive procedures cart, a treatment preparation cart, and a patient healthcare cart.

Department statistics are shown in **Table 1.**

**The Coronary Care Unit tomorrow – education of personnel, synchronization, and working together to prevent life-threatening conditions and provide rapid and high-quality care for all individuals!**

**TABLE 1. Department statistics between 2017 and May 2019.**

CORONARY UNIT	2014	2015	2016	2017	2018	May 2019
Total patients	770	771	694	711	758	218
Daily average	2.55	2.51	2.78	2.77	2.69	2.8
Total days	1961	1939	1910	1955	2016	612
STEMI*	122	147	142	107	138	47
NSTEMI*	117	95	102	127	135	43
Death	51	50	55	54	72	18
Urinary catheter	347	312	242	274	324	85
Respirator	42	93	94	95	136	30
CVC*	155	135	147	111	136	50

STEMI = ST segment elevation myocardial infarction; NSTEMI = non-ST segment elevation myocardial infarction; CVC = central venous catheter